

California High Speed Rail Authority

# Induced Wind Impacts

*Effects on Pollination; Blossoms and Dust*

Agricultural Working Group White Paper

Approved: 7/2/2012

## BACKGROUND

The California High Speed Rail Authority (CHSRA) proposes to connect the large population centers in California and thus establish a new railway in the San Joaquin Valley. The new rail alignment is proposed to be constructed either on existing farmland or adjacent to, where such land lies between urban and commercial parcels in the Valley. Most, if not all, of the Valley counties through which the railway is proposed to travel have Right-To-Farm Ordinances which make reference to "customary and/or traditional" agricultural practices. The proposed project has raised questions and concerns regarding its impact on many established and customary agricultural practices and consequent potential imposition of new regulatory restrictions. Customary agricultural practices found in the Valley are as varied as is the diversity of agricultural products and commodities produced. The San Joaquin Valley as a natural resource is unique to the state, the nation, and arguably the world by the quality and quantity in the diversity of its agriculture.

The CHSRA has created a "technical" agricultural working group to assist the CHSRA in responding to the more technically oriented questions and concerns that have been asked regarding impacts to agriculture resulting from activities during the construction phase and the daily operation of the High Speed Train (HST). The agricultural working group membership is comprised of members in possession of technical expertise in various categories of agriculture activities and infrastructure.

## ISSUE

Concern is expressed that the High Speed Train while traveling at 220mph will create wind currents that will affect pollination by damaging blossoms, disrupt bee pollination activity, reduce crop production due to dust, and cause pesticide drift. Each of these will be reviewed in this paper under individual sections.

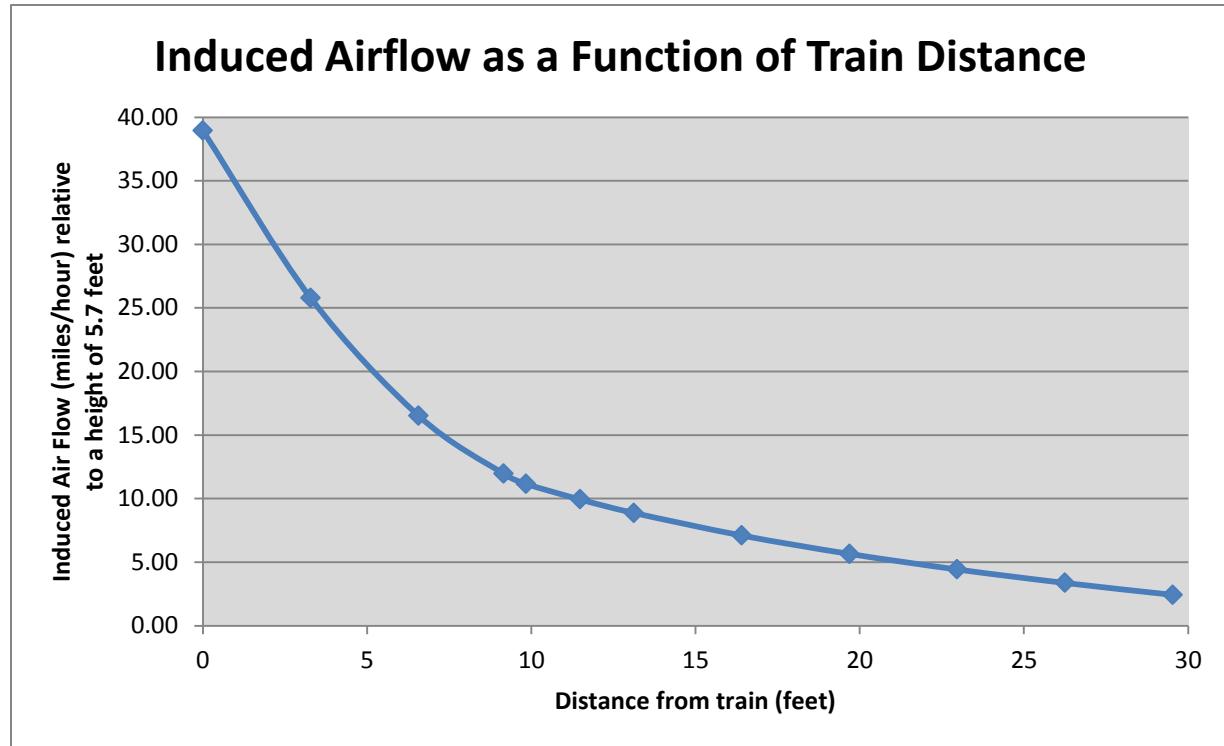
## DISCUSSION

### WIND SPEED

Any effects of induced wind by the HST on pollination will be a matter of the wind speed generated. Estimates of the generated wind speed were made independently, by separate engineering consultants using different methodologies (see attached Technical Memorandum: Potential Impact from Induced Winds for High-Speed Trains). Various reference sources were used. One of these is from Professors Sterling and Baker, both professors at the School of Civil Engineering, at the University of Birmingham, Birmingham, UK. Their studies focus mainly on the impact of induced wind (which they refer to as the "slipstream") on people waiting along the track (both workers and public) in regards to safety. Their recent paper (Sterling et al., 2008) presents two sets of induced wind profiles from the German Intercity Connect (ICE) high speed train. They indicated that they considered these to be high quality data that show the slipstream velocity as a function of the distance from the train. These data show that for trackside measurements the induced winds are between 5% and 10% of the speed of the train at 3 meters (~10ft) from the side of the train.

A second reference, (Li, et.al, "A Study of the Influence of Aerodynamic Forces on a Human Body near a High-Speed Train, Aerodynamics of Heavy Vehicles, Trucks, Buses, and Trains", 2008) utilized a curve fit

equation for estimating the wind speed and is charted below. The equation can be used up to 30ft. At this distance the estimated wind speed is approximately 2.4mph as shown in the following chart.



Induced Airflow as a Function of Distance for a Train Traveling at 220mph

Note that at 10ft from the side of the train this chart shows an approximate wind speed of 11.2mph which is within the 5-10% predicted from the research noted above (11-22mph for a HST at 220mph). These speeds are comparable to and under the meteorological data for Daily Average Wind Speed from both the Merced and Fresno airport reporting stations. The HST Right of Way standard when at grade is 100 feet wide with the two tracks being centered and 16.5 feet apart. The distance of 30 feet falls well within the HST Right of Way.

#### POLLINATION

The potential impact to pollinators, such as the honey bee, is discussed with in a separate White Paper; Bees and Pollination.

#### BLOSSOMS

The potential impact to blossoms and/or flowering trees has also been raised as a concern particularly in regards to the pollination thereof as well as the physical impact of wind to leaves and blossoms. As noted above, the HST induced wind would dissipate to about 2mph as it reaches the edge of the Right of Way. A comparable wind statistic is the Daily Average Peak Gust, where a Peak Gust is a maximum 5-second average wind speed. The meteorological data from the Western Regional Climate Center for Merced Regional Airport (1998-2008), Fresno Yosemite International Airport (1996-2008), and

Bakersfield Meadows Field Airport (196-2008) show Daily Average Peak Gusts ranged from 15.0mph to 21.3mph, 14.2mph to 21.7mph, and 14.7 mph to 21.4 mph respectively.

Throughout the season, farmers apply different crop protection products for various plant problems. Materials may be applied by airplane, helicopter, or ground units and are most commonly applied with ground based air blast spray units that have adequate air volume and speed to carry spray materials to their target which might be as far as 30 feet from the sprayer. Some of these applications occur while blossoms are present on the trees. In discussion with the manufacturer of the "Air-o-Fan" sprayer, it was noted that the velocity of air from the fan was around 140mph at the exit of the fan (Air-O-Fan Model: D-40R, (Specifications Attached). The distance from the fan and its target determines the cubic feet per minute needed to displace the internal air of the canopy. In this example, the range quoted was 40,000cfm to 350,000cfm.

Therefore, it is expected the HST will not create conditions that will cause blossom loss.

#### DUST

In arid agriculture conditions such as in the San Joaquin Valley, there are two main impacts of dust on plant foliage: photosynthesis and pests (spider mites). While there are other impacts to consider, they are generally not significant enough to be considered damaging.

Excess dust on leaves will decrease photosynthesis of the plant and have a stressing effect on the leaf's ability for respiration. A decrease in photosynthesis is a result of the reduced sunlight penetrating the dust to the leaf and can reduce the plant's productive capacity. The leaf is a plant's primary means of cooling itself by the process of transpiration. Excessive dust can inhibit transpiration, allowing leaf temperatures to rise and causing a negative effect on plant stress load.

These stresses create conditions in arid climates that have been demonstrated to foster spider mite infestations. Primary spider mite species are the Pacific, Two-spotted, and European Red spider mite, while others can be problematic at times on certain varieties of plants (e.g. Russet and Willamette spider mites). Spider mite webbing can worsen the dust collection on the plant. Spider mites also feed on the moisture in the leaves by sucking on the cell materials for their survival and multiplication. The results of this activity can cause defoliation and lower production significantly.

There are materials that can control spider mite populations, but generally the lower the dust pressure the less significant the mite pressure will be in a field. Watering roads and other dust control measures often are practiced to slow mite buildup, particularly on the perimeter of fields from where mites typically encroach. Environmentally, the mite population is most affected by moisture in the daily cycle of heating and cooling. This usually happens in the fall of the year when temperatures fall and nights become longer.

Traffic for maintenance of rail should most often be between 12:00 a.m. and 5:00 a.m., which is during the period of day when dew is most prevalent helping keep atmospheric dust to a minimum. It is

anticipated that most HST maintenance equipment will travel on the steel rails which also helps eliminate dust as it is not in contact with soil.

During construction of the HST system, contractors are obligated to control fugitive dust in accordance with California Air Resources Board and San Joaquin Valley Air Pollution Control District permits, therefore construction should have no significant impacts on adjacent crops.

Velocities within the HST Right of Way will be higher and appropriate ground maintenance should be part of standard operation procedures to further minimize the potential for conditions related to dust creation. Dust generation due to the potential for additional farm roads (related to split parcels) along the HST Right of Way may affect specific farm operations. The need for revised “Dust Plans” or operational changes, including cost impacts, would be addressed within the Right of Way process.

Therefore the HST will not create significant dust resulting in increased pests such as spider mites.

#### **DRIFF (OF PESTICIDES)**

As noted within the Agricultural Working Group White Paper on pesticide use, existing laws prohibit drift from pesticide applications. Current pesticide application practices include both ground and aerial applications. These methods are used successfully for application of pesticides in areas with transportation routes presently (roads, highways and railroads). Also noted within the AWG White Paper on pesticide use is that the HST Right of Way would be treated the same as other transportation routes. Thus concern regarding potential pesticide drift relates to the ability for the HST induced wind to draw [move] pesticides from an adjacent field into the Right of Way or into another adjoining field.

There is the general practice that the application of pesticides is not performed in winds that exceed 5-10mph. The actual limiting of application is determined by factors such as pesticide label instructions, the experience of the applicator, the perceived risk of drift involved and specific application conditions and regulations.

The situation of the HST moving pesticides from an adjacent field into the HST Right of Way or into an adjoining field is not reasonably foreseeable as a result of the wind speeds noted above.

#### **CONCLUSION**

The HST induced wind is not excessive at the edge of the right-of-way.

The effect of HST on blossoms and flowering trees is minimal due to the expected wind speed at the edge of the right-of-way.

The effect of HST induced wind on creating dust is minimal due to the expected wind speed at the edge of the right-of-way.

The risk of HST induced wind creating conditions to cause pesticide drift is minimal due to the expected wind speed at the edge of the right-of-way.